I must call your earnest attention, for it is verified in nature in the most striking way and upon the largest scale. All molecules of the same density must naturally group themselves together in the vicinity of the curvilinear axis of the tail $m^5\ m^4\ m^3$. . . . and thus form the open plume to which we have referred; but if the comet emit molecules of very unequal densities, on which the repulsive force acts with different energies, there ought to be several distinct tails, more or less curved, all situated behind the radius vector. This is precisely the case with Donati's comet. Fig. 11 proves the truth of this; it shows the comet with three distinct tails. The two smaller tails were almost straight, but always in rear of the radius vector; they presented their less marked convexity in the same direction as the bright tail.

The great comet of 1861 had also two tails. When we saw it for the first time, on June 30, it appeared to have only one, 118° long and perfectly straight, except a singular irregularity for which we could not at first account (see Fig. 12). But soon the two tails separated, and it became evident that we had been deceived by a simple play of perspective. The earth, in fact, on June 30 was in the plane of the orbit of this comet, and as the curvilinear axes of the tails are always situated in this plane, they were united, from our point of view, into one and the same straight line, or at least into one and the same arc of the great circle of the celestial vault. The sketch of the same comet (Fig. 13) seen a fortnight previously by observers in the southern hemisphere, shows clearly the disposition of this double tail, the most curved half of which almost touched the earth with its extremity.

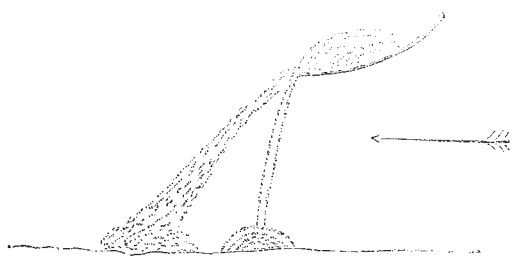

FIG. 14.

These singular effects of the repulsive force are easily explained by a comparison which will appear at first to be far removed from our subject, but the fundamental analogy of which is palpable: I refer to the winnowing of corn. In fact, we cannot better compare the entire surface-action of the repulsive force than to that of a puff of air which repels light bodies and has no sensible action upon denser bodies. When we wish to separate the grain from the chaff by means of the winnowing fan, we allow both to fall gradually into a current of air; the grain escapes from its action and falls at the feet of the winnower, while the chaff, much lighter, is carried to a distance, and forms upon the ground a separate heap (see Fig. 14). If a third material, still lighter than the chaff, is found mixed with the grains placed upon the fan, it will be drawn away still farther, and will form a third heap beyond the second. Evidently the fall into space, under the sole influence of terrestrial attraction, would not operate with such discrimination, for all matters placed upon the fan would fall at the same rate and along the same curve, whatever might be their density.

Well, the repulsive force of the sun—a surface-action, and not one of mass, like attraction—winnows, so to speak, the materials which are separated from the cometary nucleus by being rarefied; it picks them out and distributes them, according to their density, into tails of different curvatures. The lightest form the straightest tails, and those nearest to the prolonged radius vector, while the nucleus, escaping the repulsive action on account of its relatively enormous density, continues to obey, almost rigorously, the Keplerian laws of attraction.

We need not believe that the phenomenon of muliple tails is rare; without speaking of the horrible dragon depicted in Fig. 2, many comets have had several tails. The facility with which the almost straight but very feebly luminous tails of Donati's comet escaped observers in France, leads us to believe that the phenomenon may be general, and that by careful inspection several tails may almost always be found to each comet. And according to theory, a perfect homogeneity of materials, the necessary condition for a single tail, must be, for any celestial body, rather the exception than the rule.

But then, it may be said, if very dense matters are drawn away by nucleal emission on the side next the sun, ought these materials escaping the repulsive action not to take the lead of the nucleus and form a sort of tail on the side next to the sun? Yes, without doubt; and this case is effectually fulfilled, for some rare comets have presented it, such as those of 1823, 1845, and 1851. I would not insist upon these exceptional but not abnormal tails, situated on the side nearest to the sun, almost lying upon the orbit, or at least forming an obtuse angle with the initial direction of the ordinary tails.

(*To be continued.*)

DR. BHAU DAJEE

THIS very remarkable native of India, the true friend of his fellow-countrymen as well as of science and learning, died on May 31 at the comparatively early age of 51 years. As many of our readers may be ignorant of the claims of Dr. Bhau Dajee to notice, we give a brief sketch of his career, for which we are indebted to the *Times of India*.

He was born in 1823 in the village of Manjeren, near Sawunt Warree. His parents were in poor circumstances, and when he was about seven years of age they came to Bombay, bringing him with them. He was first placed in the native Education Society's Schools in Bombay, and afterwards went to the Elphinstone College. There he took a foremost place amongst the scholars, and was noted for his ability and unremitting application to his studies. The highest scholarships were taken by him, and he was specially rewarded with a gold medal. When his studies were concluded he was appointed assistant professor of chemistry and natural philosophy at the college. About this time (1842) a prize of 600 rupees was offered by Government for the best essay in English and Guzerathi on Female Infanticide. This prize Bhau Dajee gained, and the essay, which has since been published, has always been looked upon as one of the best contributions on that subject. He commenced his studies at the Grant Medical College, under Dr. Morehead, in 1845. The college had only then been established for a short time. His success here was again most marked, and gained for him the lasting friendship of many distinguished members of the medical profession. He received his diploma in 1851. He soon created a name for himself as a clever and rising medical practitioner, and quickly found himself in possession of an extensive practice amongst all classes. His time was divided between his medical duties and his historical and philological researches. From the first he took a great interest in all public questions, especially those which affected the interests of his fellow-countrymen. He, with Dr. Birdwood, was instrumental in the establishment of the Gardens and Victoria and Albert Museum, Bombay. The Bombay Association too may be said to owe its existence to his energy; he was the first secretary, and always took a deep interest in the discussions of the society on Indian affairs and measures. A considerable portion of his income was expended in procuring rare and valuable MSS. from Cashmere, Orissa, Benares, and Southern India

These he carefully translated and annotated, and numbers of the translations and remarks appeared in the scientific journals of the day both in India and in Europe. He was president of the Bombay branch of the East India Association, and up to the time of his illness constantly took part in the discussions of that body. His exertions in the cause of native female education procured for him the respect and gratitude of his more advanced fellow-countrymen. He established the Literary and Scientific Society, Bombay, and became its first president. His exertions to procure a recognised system of female education amongst the Hindoos were rewarded by a collection made by his admirers of some 12,000 rupees, which, at his request, was expended in establishing a school which has ever since been known by the name of "Bhau Dajee's Girls' School." He was elected a member of the Bombay Board of Education in 1852. He also filled the presidential chair of the Grant Medical College Society. As vice-president of the Bombay branch of the Royal Asiatic Society, he devoted a considerable portion of his spare time to furthering the interests of the society, and to the museum he presented many valuable contributions. With all the leading public questions of his time Bhau Dajee was familiar, and invariably took part in their discussion. Although he was in possession of a large practice he never accumulated a fortune, as he always willingly and readily gave money for the relief of distress. One of his latest and most important discoveries in medical science was the cure for leprosy, which he was on the point of perfecting when seized with paralysis. While ill he was most anxious that his manuscripts should be collected and got ready for publication. This duty will, we understand, be performed by his brother, Dr. Narayen Dajee, himself an accomplished scholar and well-known medical practitioner. Dr. Bhau visited many parts of India, but never went to England, though we believe he had a strong inclination to do so. Numberless instances of his public spirit and generosity might be cited did our space permit.

The public services of Dr. Bhau Dajee have been so numerous and important that it is but right that steps should be taken to commemorate them by means of a memorial, and we hope that but a short period will be allowed to elapse before some definite proposal will be laid before the public.

The deceased doctor was a member of numerous scientific societies both in India, in Europe, and in America.

OUR SULPHUR SUPPLIES

SIGNOR PARODI has addressed a report to the Italian Government, in which he gives his estimates that the sulphur of Sicily will be exhausted in fifty or sixty years. At present it is on Sicily we depend almost entirely for the supply of our sulphur—that "mainstay of present industrial chemistry"—which is so largely used in our arts and manufactures. Our demand, too, has been a steadily increasing one. In 1842 we imported 16,686 tons, and in 1862 the demand had risen to 75,000 tons. In the production of nearly every textile fabric sulphuric acid is used; it is more or less directly employed in soap and glass-making, metal refining, and the preparation of artificial manures requires large quantities. Our consumption seems to be limited only by the supply.

Recently a correspondent in the *Journal of the Society of Arts* stated, from his own experience of Sicily, that "with few exceptions, the ore is carried to the surface on the backs of boys. . . . The produce of a mine in Sicily is chiefly determined by the difficulty of getting boys . . . and the mines soon reach a depth at which they cease to be profitably worked. All the sulphur in the island, therefore, below 400 feet is untouched." He consequently doubts the correctness of Signor Parodi's estimate.

Still this report of Signor Parodi's is likely to cause some uneasiness, and the prospects of our obtaining a large supply at a cheap rate from Iceland must not be forgotten. The island is but two days' journey from Scotland, and from recent reports on the harbours there seems no reason why a continual intercourse might not be kept up. Many travellers have borne testimony to the immense fields of unworked sulphur there, and the fresh deposition in worked districts is stated to take place at a wonderfully rapid rate. In the celebrated solfatara of Puzzuoli, near Naples, after the mixture of gravel and sulphur has been submitted to the distillation of the sulphur,* the gravel is returned, and in thirty years is again so rich in sulphur as to admit of the same process. In Iceland this renewal of sulphur in the gravel is said to occupy but three years; the supply is therefore practically inexhaustible. Estimates show that while Sicilian sulphur is 5*l.* 17*s.* a ton in Britain, Icelandic would be about 2*l.* 18*s.* a ton.

According to a pamphlet by Dr. Carter Blake, recently issued, we learn that a lease for working some of the mines in the northern and eastern provinces of Iceland has been granted to Mr. Lock, of London.

A GREAT TELESCOPE

WE have already referred to the series of splendid gifts from Mr. James Lick, from San Francisco, to the State of California, the whole amounting to 2,000,000 dols. The most remarkable of these donations is one of 700,000 dols. for the purpose of erecting and endowing an astronomical observatory, and equipping it with "a powerful telescope, superior to, and more powerful than, any telescope ever yet made." The author of this magnificent bequest (the *New York Times* states) is in every sense of the word a self-made man, and has followed the wise example of the founders of our Cooper Institute and Lennox Library in securing the proper fulfilment of his trust by providing for its organisation in his lifetime. The United States already possess in the telescope of the Naval Observatory at Washington an instrument of the same gigantic proportions as that erected by Mr. Newall in this country; and we may add that this was the first instrument constructed after Mr. Newall had shown by his costly experiment that such dimensions were possible. The glass for the lenses of both these instruments was furnished by Chance and Co., of Birmingham, England. Under Mr. Lick's gift, Messrs. Alvan Clark and Sons are designated as the final judges of the most appropriate site for the proposed great telescope of California and of the world. How amply endowed will be the Lick Observatory, on the summit of the Sierra, may be conjectured from the fact that the great Washington telescope cost but 44,000 dols. The trustees who have the spending of the 700,000 dols. will be limited simply by the ability of the glass-makers to turn out a lens of sufficient size. We assume (continues the above paper) that the proposed telescope will be a refractor, since the great reflectors, of which the best known are Herschel's and Rosse's, have been found comparatively useless for accurate observations. The great speculum or object-mirror of the former was 49½ in. diameter, and the latter had two specula of 6 ft. diameter. Both were among the marvels of the generations that saw them constructed; but the latter, albeit only thirty years old, is nearly as much out of date as the former, which was constructed eighty-five years ago. It is just possible that the existence of a bequest large enough to yield six times the price which has ever been paid for a telescope may be the means of giving birth to lenses of what would now be reckoned impossible size and perfection. The 26-in. object lens of the Washington telescope has been duplicated in the one ordered by Mr. M'Cormick, of Chicago, for the Washington and Lee University of Lexington; but, though larger lenses have been talked of, their successful production is still problematical. Many costly

* Ure's Dict. of Arts, &c., vol. iii., p. 830.